

## ECAPS - Eddy Current Approach and Proximity Satellites

Completed Technology Project (2017 - 2019)



## Project Introduction

Multiple, energized coils in a small satellite will generate eddy currents in the skin of the International Space Station (ISS). This will create repulsive forces between the satellite and the ISS. Coil configurations control tip/tilt of the satellite, while lateral forces can be generated using linear induction motor concepts where the coils are energized at shifted phases to make it appear that there is a traveling magnetic field. Creating attractive forces, to balance the repulsive forces for controlled flight of the satellite, will be accomplished through a frequency dependent phase relationship between the coil current and the eddy current. This is complimentary to previous work done by another researcher. The project will begin with developing the models and performing experimental verifications of the interaction of a single coil with a conductive sheet, then expand to coupled coils in order to demonstrate lateral forces. Feasibility and capability of the ECAPS will be determined, and peer reviewed journal paper and final report will be published.

## Anticipated Benefits

Determine the feasibility of a small satellite that could "fly" around the International Space Station using magnetic field interaction (attractive and repulsive forces) with the ISS skin (non-ferrous) to control its motion. Generating significant attractive forces between a coil and a non-ferrous conductor (such as aluminum) has not been demonstrated. The use of eddy currents to generate repulsive forces is well known. Also determine the feasibility of similar satellite configuration to control the position of a satellite relative to an iron based (ferrous) asteroid. Attractive forces with ferrous objects is well understood; creating a high frequency attractive-repulsive net force is the difficulty.



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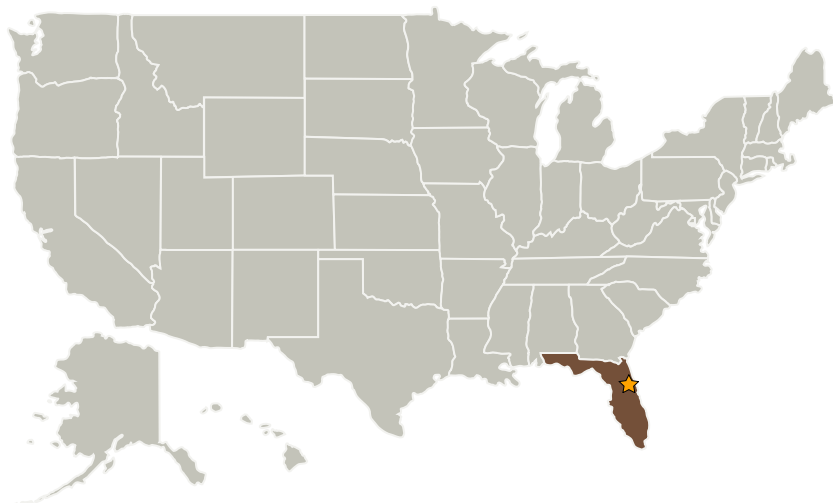
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## Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★ Kennedy Space Center(KSC)	Lead Organization	NASA Center	Kennedy Space Center, Florida
Air Force Office of Scientific Research(AFOSR)	Supporting Organization	US Government	Arlington, Virginia
Cornell University	Supporting Organization	Academia	Ithaca, New York
University of Kentucky	Supporting Organization	Academia	Lexington, Kentucky

## Primary U.S. Work Locations

Florida

## Organizational Responsibility

**Responsible Mission Directorate:**

Space Technology Mission Directorate (STMD)

**Lead Center / Facility:**

Kennedy Space Center (KSC)

**Responsible Program:**

Center Innovation Fund: KSC CIF

## Project Management

**Program Director:**

Michael R Lapointe

**Program Manager:**

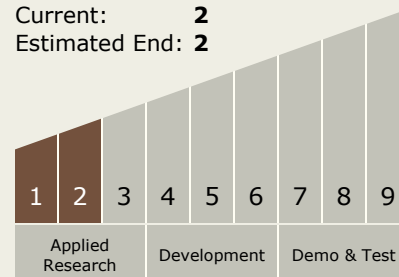
Barbara L Brown

**Principal Investigator:**

Robert C Youngquist

## Technology Maturity (TRL)

Start: **1**  
 Current: **2**  
 Estimated End: **2**



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### Project Website:

<https://www.nasa.gov/directorates/spacetech/home/index.html>

### Technology Areas

#### Primary:

- TX04 Robotic Systems
  - └ TX04.2 Mobility
    - └ TX04.2.3 Small-Body and Microgravity Mobility

### Target Destinations

Earth, The Moon